



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.

Tel: +254 (0) 799 529 958, +254 (0) 799 529 959, +254 (0) 712 524 293

Website: [www.must.ac.ke](http://www.must.ac.ke) Email: [info@must.ac.ke](mailto:info@must.ac.ke)

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## University Examinations 2018/2019

FOURTH YEAR, SPECIAL / SUPPLEMENTARY EXAMINATION FOR THE DEGREE  
OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF  
SCIENCE IN COMPUTER TECHNOLOGY

### CCS 3450: COMPILER CONSTRUCTION

DATE: SEPTEMBER 2019

TIME: 2 HOURS

INSTRUCTIONS: Answer question *one* and any other *two* questions.

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#### QUESTION ONE (30 MARKS)

- a) Describe the following terms as used with respect to compiler construction. (10 Marks)
  - (i) Syntax directed compiler
  - (ii) Code optimization
  - (iii) Derivation
  - (iv) Grammar
  - (v) Token
- b) State and briefly describe the components of a compiler and how each relates to the compilation process. (8 Marks)
- c) Distinguish between the following concepts as used with compilers
  - (i) Translator and interpreter
  - (ii) Low level language and high level language. (4 Marks)
- d) State and briefly describe the four elements of a context free grammar. (8 Marks)

#### QUESTION TWO (20 MARKS)

- a) Language processors use either translation or interpretation in converting the source program to the target program. Describe how the type of source language influences whether to use translation or an interpretation? (4 Marks)

- b) State and briefly describe the three types of computer with respect to programming languages. (6 Marks)
- c) Describe the three phases of the compilation process. (6 Marks)
- d) Ambiguous grammars may be used in programming only when accompanied by disambiguating rules. Describe the two methods used in disambiguating. (4 Marks)

**QUESTION THREE (20 MARKS)**

- a) Briefly describe the hierarchical structure of a programming language and how it helps identify the correct programs in a language. (10 Marks)
- b) Consider the grammar below for simple arithmetic expressions.

$$E \rightarrow E+E \mid E * E \mid (E) \mid -E \mid \text{identifier}$$

Using the grammar

- (i) Show that the expression  $- a + b * c - d$  is ambiguous and generating the two possible leftmost derivations. (6 Marks)
- (ii) Draw a parse tree for one of the derivation in (i) above. (4 Marks)

**QUESTION FOUR (20 MARKS)**

- a) Consider the following grammar for simple assignment statements.

Assignment statement  $\rightarrow$  statement = statement

Statement  $\rightarrow$  expression

Expression  $\rightarrow$  expression operator expression  $\mid$  (expression)  $\mid$  - expression  $\mid$  identifier

Operator  $\rightarrow$  +  $\mid$  -  $\mid$  \*

Given the statement  $A=B+C*(D-E)$  and applying the necessary products

- (i) Show whether the statement is a sentence in the language of this grammar. (6 Marks)
- (ii) Construct a parse tree for the statement (6 Marks)
- b) Describe the three address code for intermediate code generation and describe the three representations for the three address code. (8 Marks)

**QUESTION FIVE (20 MARKS)**

- a) Consider the while-loop statement in a programming language of your choice, between C, C++ and java. While indicating the chosen programming language
- (i) Give the general structure of the while-loop statement. (2 Marks)
  - (ii) Give four productions that may be used in the grammar for the while-loop statements in the language chosen. (8 Marks)
- b) Describe two other language processors used together with a compiler. (4 Marks)
- c) With the help of an example, briefly describe the two stage mapping from name to value during storage allocation. (6 Marks)